REMARKS

By this amendment, Applicant has amended claim 1 to include therein the limitations previously recited in dependent claims 9 and 15, and has amended claim 2 to include therein the limitations previously recited in dependent claims 12 and 16. Accordingly, claims 9, 12, 15 and 16 have been canceled without prejudice or disclaimer. Claims 1 and 2 have also been amended to recite that the units for maintaining the columns at predetermined temperatures are temperature controlled tanks. See, e.g., Figure 1 and the description in the third and fourth full paragraphs on page 6 of Applicants' substitute specification. Applicant has also added new claims 19-22 to define further aspects of the present invention. These claims are supported by, e.g., Figure 1 and the third and fourth full paragraphs on page 6 of Applicants' substitute specification.

The interpretation of the claims in numbered section 3 of the Office Action is traversed. The Office Action alleges that the limitations "configured to ..." are directed to the manner in which the claimed apparatus is intended to be used, do not distinguish the claimed apparatus from the prior art and do not further structurally limit the claimed apparatus. However, the fact that, for example, the reduction column of claim 1 is configured to receive four separate nitropolycyclic aromatic hydrocarbons from the separation column requires that, *inter alia*, the separation column and reduction column be connected in a manner that the reduction column receives the at least four separate nitropolycyclic aromatic hydrocarbons from the separation column. This is clearly a structural limitation on the apparatus and is more than a mere

recitation of intended use.

The Examiner's interpretation of "configured to" to mean "capable of" finds no basis the specification, file history or the plan meaning of the words "configured to." While the Examiner's interpretation may make it more convenient for the Examiner to support the erroneous rejections in the Office Action, the interpretation is simply not correct. The words "configured to" require that the columns be arranged and set up to have the specified functions, e.g., to "receive the methanol water mixture and the sample from the auto-sampler" in the case of the separation column. This requires more than the columns being merely "capable of" performing the functions, but requires the columns to be arranged and set up to perform those functions.

Therefore, the interpretation of the claims in numbered section 3 of the Office Action is erroneous.

The Examiner has again objected to the specification in numbered section 3 of the Office Action as failing to provide proper antecedent basis for the claimed subject matter. In support of this, it has been urged that a separation column specifically designed (structurally) to separate a sample into four specific isomers of nitro-PAH lacks antecedent basis. Applicant again traverses this objection and requests reconsideration thereof.

The present claimed invention relates to an apparatus for analyzing nitropolycyclic aromatic hydrocarbons and includes a silica gel/C8 separation column configured to separate the sample containing nitropolycyclic aromatic hydrocarbons into at least four separate nitropolycyclic aromatic hydrocarbons. It is again noted the claims no longer call for a separation

column to separate a sample into four specific "isomers." Support for the claims as presently amended, including the presently claimed separation column, can be found at, e.g., the third full paragraph on page 6 of the Substitute Specification.

Accordingly, reconsideration and withdrawal of the objection to the specification in numbered section 3 of the Office Action are requested.

Claims 1,9 and 15 stand rejected under 103(a) as being unpatentable over JP 2001-021497 to Iwabuchi et al. in view of the Jinno et al. article, Applicant traverses this rejection and requests reconsideration thereof.

The rejected claims relate to an apparatus for analyzing nitropolycyclic aromatic hydrocarbons. The apparatus includes an auto-sampler to which a methanol water mixture and a sample comprising nitropolycyclic aromatic hydrocarbons are sent; a silica gel/C8 separation column downstream of the auto-sampler configured to receive the methanol water mixture and the sample from the auto-sampler and configured to separate the sample containing nitropolycyclic aromatic hydrocarbons into at least four separate nitropolycyclic aromatic hydrocarbons including 1-nitropyrene, 1,3-dinitropyrene, 1,6-dinitropyrene and 1,8-dinitropyrene; an alumina/Pt-Rh reduction column downstream of the separation column configured to receive the at least four separate nitropolycyclic aromatic hydrocarbons including 1-nitropyrene, 1,3-dinitropyrene, 1,6-dinitropyrene and 1,8-dinitropyrene from the separation column and to aminate the separated nitropolycyclic aromatic hydrocarbons; and a fluoresce detector. The apparatus also includes temperature controlled tanks for maintaining the separation column at a first

predetermined temperature higher than room temperature and for maintaining the reduction column at a second predetermined temperature higher than the first predetermined temperature. See, claim 1. The apparatus can also include an analysis column for separating an interfering component contained in the sample from the aminated separated nitropolycyclic aromatic hydrocarbons. See, claim 2.

As described at the paragraph bridging pages 2 and 3 of Applicant's Substitute Specification, the Iwabuchi et al. publication discloses a nitrogen-containing organic substance analyzer comprising a reduction column for reducing the nitrogen-containing organic substance, a separation column for separating the nitrogen-containing organic substance, a means for adding a reaction reagent to the reduced and separated nitrogen-containing organic substance for causing chemiluminescence emission for detection, and a means for setting the reduction column arbitrarily to a temperature within the range of 90 to 150° C., so that the nitrogen-containing organic substance is reduced within the temperature range of 90 to 150° C.

The Office Action appears to equate the reduction column 17 of Iwabuchi et al. to the reduction column of the present invention. However, it appears the reduction column 17 of Iwabuchi et al. reduces the nitroarene from separation column 9. Based on the English abstract of Iwabuchi et al., it appears the polycyclic aromate component from separation column 9 is sent to a separation column 10, not to the reduction column 17. Thus, it does not appear the reduction column 17 of Iwabuchi et al. is configured to receive at least four separate nitropolycyclic aromatic hydrocarbons from the separation

column 10 and to aminate the separated nitropolycyclic aromatic hydrocarbons.

In addition, Iwabuchi discloses a reduction column that is kept warm, but not a separation column that is kept warm. In Iwabuchi, a sample sent from a pump 5 and a sampler 7 remains in a separation column 9, a flow of the sample and an eluent 2 is changed by a pump 6 and is sent to a reduction column 17. Therefore, Iwabuchi fails to disclose a configuration allowing a sample and an eluent to be supplied to the separation column and the reduction column from the auto-sampler. Thus, the present invention differs from Iwabuchi in that the methanol water and nitropolycyclic aromatic hydrocarbons are kept warm in the both the separation column (at a first temperature higher than room temperature by a temperature controlled tank) and the reduction column (at a temperature higher than the first predetermined temperature by another temperature controlled tank) and sent out by the auto-sampler, so that the present invention is able to detect with high accuracy the nitropolycyclic aromatic hydrocarbons contained in diesel particles from the exhaust of diesel engines.

The Jinno et al. article discloses that various chemically bonded C_{60} fullerene silica phases were synthesized as stationary phases for liquid chromatography and their retention behaviors were evaluated systematically with the various polycyclic aromatic hydrocarbons using microcolumn LC. While this article discloses that the planarity recognition capability of the C_{60} bonded phases increases with increasing temperature, this article in no way renders obvious the presently claimed invention in which, in the claimed

apparatus for analyzing nitropolycyclic aromatic hydrocarbons, a temperature controlled tank is provided for maintaining a cyclic gel/C8 separation column at a first predetermined temperature higher than room temperature while another temperature controlled tank is provided for maintaining an alumina/Pt-Rh reduction column at a second predetermined temperature higher than the first predetermined temperature.

Moreover, as recognized by the Examiner, neither Iwabuchi et al. nor Jinno et al. discloses the use of a silica gel/C8 separation column.

The present invention is configured to analyze a component of nitropolycyclic aromatic hydrocarbons with only two columns, i.e., a reduction column and separation column, and enables detection by using a fluorescence detector. Accordingly, the present invention is able to effectively analyze, with high accuracy, the nitropolycyclic aromatic hydrocarbon contained in diesel particulates from the exhaust of diesel engines. The advantages of the claimed invention are achieved by maintaining a silica gel/C8 separation column at a temperature higher than room temperature, e.g., 40ºC, using a reduction column maintained at higher temperature than that of the separation column, and supplying the sample directly from the auto-sampler to the separation column and the reduction column, in that order. Such is neither disclosed by nor obvious over Iwabuchi et al. and Jinno et al.

Claims 1, 9 and 15 stand rejected under 35 U.S.C. 103(a) as being unpatentable over the Li et al. article in view of Jinno et al. Applicant traverses this rejection and requests reconsideration thereof.

The Li et al. article discloses that the determination of mono- and di-nitro polycyclic aromatic hydrocarbons (PAHs) was accomplished by on-line reduction to the corresponding amino PAHs, which were then separated and detected using high-performance liquid chromatography (HPLC) and chemiluminescence detection. On page 179 of this article, chromatograms are shown in which 2(A) is a chromatogram of a standard mixture. Peaks: 1 = 1,8- dinitropyrene, 2 = 2-nitroanthracene, 3 = 1-nitropyrene, 4 = 6-nitrocnrysene, 5 = 3-nitroperylene and 6 = 1-nitroperylene, (B) and (C) are chromatograms of a diesel particulate extract from fractions containing mono-nitro PAHs and di-nitro PAHs, respectively, and (D) and (E) are chromatograms of a diesel exhaust emission filter extract sample from fractions containing mono-nitro PAHs and di-nitro PAHs, respectively.

While the introduction of Li et al. mentions that "great attention has been directed to 1-nitropyerene and 1, 3-, 1, 6- and 1,8-dinitropyrenes," it does not appear that the Li et al. article discloses a separation column for separating a sample comprising nitropolycyclic aromatic hydrocarbons into at least four separate components including 1-nitropyrene, 1,3-dinitropyrene, 1,6-dinitropyrene and 1,8-dinitropyrene. Rather, in Li et al, the nitro PAHs are first reduced to amino PAHs using a catalyst column (see, the section 2.3 bridging pages 178 and 179 of Li et al). It is the amino PAHs that are separated by chromatographic separation (see, section 2.4 on page 179 of Li et al). Accordingly, the Li et al. article does not disclose and would not have rendered obvious the presently claimed invention including a separation column configured to separate a sample containing nitropolycyclic aromatic

hydrocarbons into at least four separate nitropolycyclic aromatic hydrocarbons including 1-nitropyrene, 1,3-dinitropyrene, 1,6-dinitropyrene and 1,8-dinitropyrene.

Moreover, the separation column in Li et al. is not disclosed to be a silica gel/C8 separation column, as now recited in claims 15 and 16.

The present invention also includes an auto-sampler to which a methanol water mixture and the sample comprising nitripolycyclic aromatic hydrocarbons are sent. The separation column is configured to receive the methanol water mixture and the sample from the auto-sampler. On the other hand, in Li et al., the methanol water mixture and the sample are sent first to the catalyst column. It is disclosed that "[b]ecause the methanol-water solution is not appropriate to the chemiluminescence detection system, it is necessary to change to an acetonitrile-buffer solution as mobile phase by using a switch valve." The chromatographic separation of the amino compounds is then carried out in Li et al. using the acetonitrile-buffer solution; the chromatographic separation column is not configured to receive the sample and methanol water mixture from an auto-sampler.

Moreover, according to the present invention, the reduction column is configured to aminate the separated nitripolycyclic aromatic hydrocarbon is downstream of the separation column. The opposite is true in Li et al. On-line reduction using a catalyst column is first carried out and then chromatographic separation is carried out downstream of the catalyst column.

For the reasons noted above, the Jinno et al. article does not remedy these deficiencies in Li et al. Accordingly, the presently claimed invention is

patentable over the proposed combination of Li et al. and Jinno et al.

Claim 17 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Iwabuchi et al. and Jinno et al in view of Collins or Anthony and over Li et al. and Jinno et al. in view of Collins or Anthony. Applicant traverses these rejections and requests reconsideration thereof.

None of Iwabuchi et al., Li et al. and Jinno et al. discloses or would have rendered obvious the apparatus for analyzing nitropolycyclic aromatic hydrocarbons set forth in claim 1 for the reasons noted above and clearly do not disclose or suggest the apparatus set forth in dependent claims 17 and 18, including an ultrasonic generator provided upstream of the auto-sampler for applying ultrasonic waves to a mixture of diesel particulates and an organic solvent to dissolve soluble organic fractions of the diesel particulates in the organic solvent.

While the office action cites Collins and Anthony as disclosing ultrasonic solvent extraction of solubles from solid samples, such extraction is completely unrelated to an apparatus for analyzing nitropolycyclic aromatic hydrocarbons. Accordingly, it is submitted there would not have been any apparent reason to combine the teachings of Collins or Anthony with those of Iwabuchi et al. nor Li et al. Therefore, claims 17 and 18 are patentable over the proposed combination of documents.

In view of the foregoing amendments and remarks, favorable reconsideration and allowance of all the claims now in the application are requested.

Please charge any shortage in the fees due in connection with the filing of this paper, to the deposit account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (Case: 648.45478X00), and please credit any excess fees to such deposit account.

Respectfully submitted,

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